

This listing of the claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

1. (Currently amended) A method comprising:

providing a substrate structure into a ~~chamber of a first~~ processing tool;

forming a barrier layer on the substrate structure;

forming a metal seed layer over the barrier layer;

~~performing in situ surface treatment of the substrate structure having the metal seed layer and the barrier layer thereon to form~~ forming a passivation layer over the metal seed layer while in the processing tool.

2. (Currently amended) The method of claim 1 wherein ~~in situ surface treatment is performed~~

forming the passivation layer comprises forming a passivation layer in a gas environment

selected from the group consisting of inert gases, hydrogen gas, fluorine containing gas, forming gas, oxygen gas and nitrogen gas.

3. (Currently amended) The method of claim 1 wherein ~~in situ surface treatment is performed~~

forming the passivation layer comprises forming a passivation layer using a liquid selected from

the group consisting of acids, bases, solvents and di-ionized water.

4. (Currently amended) The method of claim 2 wherein ~~in-situ surface treatment is performed~~
forming the passivation layer comprises forming a passivation layer in an oxygen gas environment to form a metal oxide layer on the metal seed layer.
5. (Original) The method of claim 1 wherein the metal seed layer is selected from the group consisting of copper, copper alloy, nickel, silver, gold and cobalt.
6. (Original) The method of claim 1 wherein the barrier layer is selected from the group consisting of tantalum, tantalum nitride, titanium, titanium nitride, tungsten nitride, tungsten-tantalum and tantalum silicon nitride.
7. (Currently amended) The method of claim 1 wherein the ~~first~~ processing tool is a metal-barrier deposition tool.
8. (Currently amended) The method of claim 1 wherein ~~performing the in-situ surface treatment~~
forming the passivation layer comprises:
filling the chamber of the ~~first~~ processing tool with a gas for a first specified period of time,
and
cooling the substrate structure having the metal seed layer and the barrier layer thereon in the chamber at a specified temperature for a second specified period of time, ~~to form a~~
~~passivation layer on the metal seed layer.~~

9. (Original) The method of claim 8 wherein the first specified period of time is in a range of approximately 15-25 seconds.
10. (Original) The method of claim 8 wherein the second specified period of time is in a range of approximately 5-15 seconds.
11. (Original) The method of claim 8 wherein the specified temperature is about 15-20° C.
12. (Original) The method of claim 8 wherein the gas comprises oxygen gas at a pressure of up to 2 torr.
13. (Currently amended) The method of claim 1 further ~~comprises~~ comprising providing the substrate structure with the barrier layer, metal seed layer and the passivation layer into a contamination removal chamber of an electroplating tool.
14. (Currently amended) The method of claim 13 further ~~comprises~~ comprising annealing the substrate structure in forming gas to ~~reduce~~ remove the passivation layer.
15. (Currently amended) The method of claim 14 wherein annealing comprises flowing forming gas into ~~the~~ an anneal chamber for a ~~third~~ first specified period of time at a seed anneal cooling temperature of about 250 ° C.

16. (Currently amended) The method of claim 15 ~~wherein annealing further comprises~~ comprising cooling the annealed substrate in forming gas for a ~~fourth~~ second specified period of time at a seed anneal cooling temperature of about 15-20 ° C.
17. (Currently amended) The method of claim 15 wherein the ~~third~~ first specified period of time is about 30 seconds.
18. (Currently amended) The method of claim 16 wherein the ~~fourth~~ second specified period of time is about 25 seconds.
19. (Original) The method of claim 14 wherein the forming gas comprises about 95 percent nitrogen and 5 percent hydrogen.
20. (Currently amended) The method of claim 14 further ~~comprises~~ comprising depositing a conductive material at least in a trench and a via patterned on the substrate structure using a plating method selected from the group consisting of electrolytic plating and electroless plating.
21. (Original) The method of claim 20 wherein the conductive material is selected from the group consisting of copper, silver and gold.
22. (Currently amended) A method comprising:

providing a substrate into an electroplating tool, the substrate having at least a trench and at least a via patterned thereon, a barrier layer formed in the trench and the via, a metal seed layer formed on the barrier layer and a passivation layer formed on the metal seed layer, wherein the metal seed layer and the passivation layer are formed substantially sequentially within a same processing tool;

annealing the substrate in forming gas to ~~reduce~~ remove the passivation layer; and depositing a conductive material at least inside the trench and the via of the substrate using a plating process selected from the group consisting of electrolytic plating and electroless plating.

23. (Currently amended) The method of claim 22 wherein the annealing and depositing are performed substantially sequentially for each substrate in a substrate batch under vacuum conditions within the electroplating tool.

24. (Currently amended) The method of claim 22 wherein annealing comprises flowing forming gas into a contamination removal chamber of the electroplating tool for a ~~third~~ first specified period of time at a seed anneal temperature of about 250 ° C.

25. (Currently amended) The method of claim 22 24 ~~wherein the annealing~~ further comprises comprising cooling the annealed substrate in forming gas for a ~~fourth~~ second specified period of time at a temperature of about 15-20 ° C.

26. (Currently amended) The method of claim 24 wherein the ~~third~~ first specified period of time is about 30 seconds.

27. (Currently amended) The method of claim 25 wherein the ~~fourth~~ second specified period of time is about 25 seconds.

28. (Currently amended) A system comprising:

at least one contamination removal chamber to perform seed anneal of a substrate, the substrate having at least a trench and a via patterned thereon, a barrier layer formed in the trench and the via, a metal seed layer formed on the barrier layer, and a seed passivation layer formed on the metal seed layer, wherein the metal seed layer and the seed passivation layer are formed substantially sequentially within a same processing tool;

a gas delivery system coupled to the at least one contamination removal chamber to introduce a forming gas into the contamination removal chamber to ~~reduce~~ remove the seed passivation layer; and

at least one plating chamber coupled to the at least one contamination removal chamber and to the gas delivery system, the at least one plating chamber for depositing a conductive material at least inside the trench and the via of the substrate using a plating process selected from the group consisting of electrolytic plating and electroless plating.

29. (Currently amended) The system of claim 28 wherein performing seed anneal and depositing a conductive material are performed substantially sequentially for each substrate batch under vacuum conditions within the electroplating tool.

30. (Currently amended) The system of claim 28 wherein the gas delivery system introduces into the contamination removal chamber hot forming gas at a ~~third~~ temperature of about 250° C for about 30 seconds followed by cool forming gas at a ~~fourth~~ temperature of about 20° C for about 25 seconds.

31. (New) A machine accessible media having associated instructions, which when accessed by one or more machines, results in the one or more machines performing:

- providing a substrate structure into a processing tool;

- forming a barrier layer on the substrate structure;

- forming a metal seed layer over the barrier layer;

- forming a passivation layer over the metal seed layer while in the processing tool.

32. (New) The media of claim 31, wherein the instructions for forming the passivation layer further include instructions, which when accessed by the one or more machines, results in the one or more machines performing selected ones of :

- forming the passivation layer in a gas environment selected from the group consisting of inert gases, hydrogen gas, fluorine containing gas, forming gas, oxygen gas and nitrogen gas; and

forming the passivation layer using a liquid selected from the group consisting of acids, bases, solvents, and di-ionized water.